Comp 250 Assignment 3

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Question 2

$$T(0) = 0$$
$$T(n) = 2T(n-1) + 4^n + 1$$

$$\begin{aligned}
T(n) &= 2T(n-1) + 4^n + 1 \\
&= 2T(2T(n-2) + 4^n + 1) + 4^n + 1 \\
&= 4T(n-2) + 8^n + 2 + 4^n + 1 \\
&= 4T(2T(n-3) + 4^n + 1) + 8^n + 2 + 4^n + 1 \\
&= 8T(n-3) + 16^n + 4 + 8^n + 2 + 4^n + 1 \\
&= 2^3 T(n-3) + 2^{4n} + \frac{2^3}{2} + 2^{3n} + \frac{2^2}{2} + 2^{2n} + \frac{2^1}{2} \\
&= 2^k T(n-k)) + \sum_{i=1}^{k} 2^{(i+1)n} + \frac{2^k}{2}
\end{aligned}$$

T(n) hits base at n=0, or when k=n.

$$T(n) = 2^k T(n-k) + \sum_{i=1}^{k} (2^{(i+1)n} + \frac{2^k}{2})$$
$$T(n) = 2^k T(0) + \sum_{i=1}^{k} (2^{(i+1)n} + \frac{2^k}{2})$$
$$T(n) = \sum_{i=1}^{n} (2^{(i+1)n} + \frac{2^n}{2})$$